PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:
Brittan L. Pasloske
William Wu

Serial No.: 09/815,557

Filed: March 23, 2001

For: METHODS AND REAGENTS FOR INACTIVATING RIBONUCLEASES.

Group Art Unit: 1651

Examiner: Crane

Atty. Dkt. No.: AMBI:054US/MBW

CERTIFICATE OF MAILING
37 C.F.R 1.8

I hereby certify that this correspondence is being deposited with the U.S. Postal Service with sufficient postage as First Class Mail in an envelope addressed to: Commissioner for Patents, Washington, DC 20231, on the date below:

5/28/2002 Mark B. Wilson
Date

DECLARATION OF DR. BRENT IVERSON UNDER 37 C.F.R. §1.132

Hon. Commissioner for Patents
Washington, D.C. 20231

I, Brent Lee Iverson, hereby declare as follows:

1. I am a U.S. citizen residing at 1316 Thaddeus Cove, Austin Texas. I am a Professor at the University of Texas at Austin in the Department of Chemistry and Biochemistry and I am also a member of the Institute of Cellular and Molecular Biology at the University of Texas at Austin. A copy of my *Curriculum Vitae*, outlining my education, research training and my current research program, is attached. I am also a member of the Ambion Scientific Advisory Board. I am being compensated for my time in preparing this declaration, but not for the content of the statements contained herein.

2. I understand that the present invention relates to methods for inactivating ribonucleases in an admixture comprising a cell or a cellular extract and compositions and kits for carrying out such methods. These methods involve the use of a reducing agent and heat, as set forth in the specification and claims, for example at page 11, lines 22-23. In some specific embodiments, these methods are methods for producing cDNA from cellular extracts, as described in the specification and claims, for example at page 8, lines 30-32.

3. I understand that the examiner has rejected the claims of the present application on a variety of grounds. I have reviewed a copy of the Official Action dated November 27, 2001, the pending claims, the application as filed, the Murthy *et al.* reference cited by the examiner and the Chomczynski reference cited by the examiner. In light of these documents, and my knowledge of the field of molecular biology, I make the following statements.

4. I understand that the examiner has asserted that skilled molecular biologists would not be able to practice the claimed invention with any reducing agents that are not "thiol containing reducing agents." I do not find this to be the case.

5. The specification clearly sets forth that many agents and reducing agents are known to those of skill, see, for example, page 6, lines 20-23. The specification also sets forth assays that can be used by one of ordinary skill in the art to determine, without undue experimentation, whether or not any given reducing agent will work in the context of the invention. For example, such assays are described in Example 1 of the specification, at page 12, line 6, to page 13, line 26.

6. In view of the above, a skilled molecular biologist will be able to practice the claimed invention with any reducing agent that will function in the context of the invention, including but not limited to, "thiol containing reducing agents."

7. It is my understanding that the examiner in charge of the above-captioned application has indicated that the specification in the above-referenced patent application does not teach one skilled in the art how to make and use the invention with ribonucleases other than RNase A, RNase 1, and RNase T1.

8. A skilled molecular biologist will readily apply the methods disclosed in the specification, for example, at page 14, line 20, to page 16, line 24, to inactivate ribonucleases including, but not limited to, RNase A, RNase 1, and RNase T1. The inactivations of RNase A, RNase 1, and RNase T1 disclosed in the specification are examples that prove that the methods work.

9. That the disclosed methods can be used to inactivate ribonucleases in general, in addition to RNase A, RNase 1, and RNase T1, is apparent from the specification, for example, at page 6, lines 8-15; page 7, lines 25-28; and page 11, lines 22-23.

10. Furthermore, the specification teaches how to test for inactivation of other ribonucleases at page 12, line 6, to page 14, line 26. Determining whether the methods disclosed in the specification are effective to inactivate any given ribonuclease requires merely routine experimental work by a laboratory technician trained in standard techniques.

11. Therefore, a skilled molecular biologist will be able to read the specification and use the claimed methods to inactivate any ribonucleases, including but not limited to RNase A, RNase 1, and RNase T1. Because of this, the examiner is incorrect in his position that the specification does not teach one skilled in the art how to make and use the invention with ribonucleases other than RNase A, RNase 1, and RNase T1.

12. It is my understanding that the examiner claims that Murthy and Sirdeshmukh, "Sensitivity of monomeric and dimeric forms of bovine seminal ribonuclease to human placental

ribonuclease inhibitor," *Biochem. J.*, 281:343-348 (1992), teach the use of dithiothreitol (DTT) to inactive ribonucleases.

13. I disagree with the examiner's conclusion that the Murthy *et al.* reference, as read by a skilled molecular biologist, teaches the use of DTT to inactivate ribonucleases.

14. In Fig. 1 of Murthy *et al.*, to which the Examiner refers as support for his conclusion, there was no inhibition of the ribonucleases studied when they were exposed to DTT without human placental ribonuclease inhibitor. The remainder of the figures and the text of Murthy *et al.* support this interpretation of the data. Therefore, contrary to the Examiner's interpretation, one of skill in the art, upon reading the Murthy *et al.* reference, without the benefit of the teachings of the present application and inventors, would believe that DTT cannot be used to inactivate ribonucleases. I believe that the presently claimed invention works where Murthy *et al.* failed because it employs a combination of a reducing agent and heat to inactivate ribonucleases, which Murthy does not.

15. The Murthy *et al.* reference does not teach or suggest the use of DTT or any other reducing agent to inactivate ribonucleases. Furthermore, the Murthy *et al.* reference does not provide any motivation to use DTT or any other reducing agent to inactivate ribonucleases or suggest any likelihood of success in doing so. Indeed, Murthy *et al.* indicates that neither DTT nor other reducing agents can be used to inactivate ribonucleases under the conditions disclosed in it, and this would have suggested to skilled molecular biologists without the benefit of the teachings of the present application that the methods claimed in the present application would not succeed.

16. Therefore, a skilled molecular biologist would not read Murthy *et al.* to teach or suggest the use of DTT or any other reducing agent to inactive ribonucleases. In fact, a skilled molecular biologist would have been actively dissuaded from using DTT or any other reducing agent to inactivate ribonucleases, based on the information provided in Murthy *et al.*

17. I understand that the Examiner has suggested that Chomzynski, U.S. Patent No. 5,945,515 is relevant to the present claims. The skilled molecular biologist would not be motivated toward the present invention or expect success in the practice of the claimed invention based on Chomzynski, for the reasons below.

18. Those skilled molecular biologists understand that the method of Chomzynski relies on the use of chaotropic agents, usually guanidinium-based compounds in their isolation processes. These chaotropic agents inhibit the activity of enzymes, including RNases. Because of this, one of ordinary skill would not be motivated toward the present invention by Chomzynski, for at least two reasons.

19. First, the chaotropic agents employed in Chomzynski are sufficient to inhibit any RNase that may be present in the Chomzynski preparations. Therefore, in Chomzynski's compositions containing chaotropic agents, there is no need for an additional agent, such as a reducing agent, to inhibit ribonucleases. Further, in embodiments described in Chomzynski where a reducing agent is included in addition to the chaotropic agent, there is no heating of the compositions, and the procedures are performed at room temperature or below.

20. Additionally, those of ordinary skill would expect the chaotropic agents employed by Chomzynski to inactivate any proteins added to the admixtures of the present claims, including reverse transcriptase. For this reason, the methods of Chomzynski require washing of isolated RNA and DNA by centrifugation, pelleting, and resuspension of the nucleic acid in a solution that does not comprise the chaotropic agent, before that nucleic acid is used in a PCR or RT-PCR procedure. Those of ordinary skill would not expect the chaotropic agent-containing lysates of Chomzynski to be useful in the methods of the present invention in which reverse transcriptase or another enzyme is added directly to an extract of a cell, because the chaotropic agents would inactivate that enzyme.

21. In contrast to the method of Chomzynski, the methods of the present invention do not require a chaotropic agent to inactivate ribonucleases. As shown in the specification, at page 17, line 1, to page 18, line 4, reducing agents do not effect enzymes such as reverse transcriptase and DNase I. Therefore, it is possible, in the context of the present invention, but not Chomzynski's method, to add enzymes directly to a cell extract containing the agent used to inactivate any ribonucleases and perform, for example, a reverse transcriptase reaction to produce cDNA.

22. I declare that all statements made herein of our my knowledge are true, and that all statements of my own belief are believed to be true, and further that these statements were made with the knowledge that willful false statements are punishable by fine or imprisonment, or both, under § 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of this patent, and any reexamination certificate issuing thereon.

5/28/02
Date

Brent L. Iverson, Ph.D.

CURRICULUM VITAE

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Education:

B.S. in Chemistry (with honors), Stanford University, Palo Alto, CA, 1982.
Ph.D. in Chemistry with **Professor Peter Dervan**, California Institute of Technology, Pasadena, CA, 1987.
Postdoctoral Work with **Dr. Richard Lerner**, Scripps Research Institute, La Jolla, CA 1987-1990.

Academic and Research Awards:

Elected to Phi Beta Kappa, 1982
American Cancer Society, California Division Postdoctoral Junior Fellowship, 1987-1989
Camille and Henry Dreyfus Foundation New Faculty Award in Chemistry, 1990
The Chicago Community Trust Searle Scholars Award, 1991
National Science Foundation Presidential Young Investigator Award, 1991
Camille and Henry Dreyfus Foundation Teacher-Scholar Award, 1995
Alfred P. Sloan Foundation Research Fellow, 1996

Teaching and Service Awards:

University of Texas Natural Sciences Advisory Council Teaching Excellence Award, 1993
The Friar's Centennial Teaching Award, 1994
Mexican American Health Professions Professor of the Year, 1994
The Eyes of Texas University Service Award, 1994
University of Texas Natural Sciences Advisory Council Teaching Excellence Award, 1997
CIT (Center for Instructional Technology) Faculty Fellow, 1998
Elected to the Academy of Distinguished Teachers, UT Austin, 1999
Texas Ex's Teaching Excellence Award, 2000
Jean Holloway Teaching Excellence Award, 2001

Research and Professional Experience:

1979-1982	**Undergraduate Research Assistant** at Stanford University in the laboratory of Professor James Collman.
1982-1987	**Graduate Research Assistant** in the laboratory of Professor Peter Dervan at the California Institute of Technology.
1987-1989	**Postdoctoral Research Fellow** at the Scripps Research Institute in the laboratory of Dr. Richard Lerner.
1989-1990	**Senior Research Associate** at the Scripps Research Institute,.
1990-1996	**Assistant Professor**, Department of Chemistry and Biochemistry, the University of Texas at Austin.
1996-2001	**Associate Professor**, Department of Chemistry and Biochemistry, the University of Texas at Austin
1998-	**Member** of the Institute for Cellular and Molecular Biology, the University of Texas at Austin
2001-	**Professor**, Department of Chemistry and Biochemistry, the University of Texas at Austin

Current Research Interests:

The Production, Characterization, and Manipulation of Large, Functional Molecules from Several Different Points of View. 1. Antibody and Enzyme Engineering with an emphasis on developing better methods for recombinant antibody or enzyme cloning and directed evolution. Three important new technologies have been developed: A novel *E. coli* surface expression / FACS selection technology, an *in vitro* method for the systematic enhancement of antibody and enzymes and a novel large-scale expression system for the production of large quantities of recombinant antibodies. Emphasis is currently on developing effective strategies to counteract biological weapons. 2. The chemistry of nucleic acid binding, recognition and modification with a primary focus on understanding and exploiting our newly created polyintercalating molecules called serpentercalators. These molecules show sequence specificity, are amenable to combinatorial techniques and some derivatives are active against Gram positive bacteria. The smaller derivatives bind to DNA in a cooperative manner, a property currently being exploited as a new paradigm to create sequence specificity with very small molecules. 3. Artificial macromolecules with defined higher order structure and function. These systems involve the predictable folding of synthetic molecules into stable scaffolds, based on abiotic secondary structure elements. Our first generation molecules, called aedamers, fold in aqueous solution due to the stacking of alternating electron rich and electron deficient aromatic units. We will use these scaffolds to create large synthetic molecules with important new properties and functions.

Other Positions Held at the University of Texas:

Chair, Classroom Multimedia Enhancement Task Force, **1998-1999**
Undergraduate Advisor, Department of Chemistry and Biochemistry, **1998-2001**
Chair, newly reconstituted Courses and Curriculum Committee, Department of Chemistry and Biochemistry, **2000-2001**

Former Service and Committee Activities at the University of Texas:

Graduate Student Recruiting for the Organic Division, **1991-1993**
Appointed to the Chairman's Strategic Planning Committee, **1993**
Moore-Hill Dormitory Faculty Fellow, **Spring 1993**
Kinsolving Dormitory Faculty Fellow, **Summer 1993, Fall 1994, Spring 1995**
Jester Dormitory Faculty Fellow, **Fall 1995, Fall 1998, Spring and Fall 1999, Spring 2000**
Elected to the Molecular Biology Institute Advisory Committee, **1993-1995**
Computer Committee, Department of Chemistry and Biochemistry, **1993-1995**
Organic Chemistry Seminar Coordinator, **1995-1997**
Multimedia and Instruction Committee, **1996-1998**
Departmental Courses and Curriculum Committee, **1997-2000**

Current Service and Committee Activities at the University of Texas:

Annual participation in Camp Texas, **1994-present**
Coordinator of Dean's Scholars weekly seminar, **1995-present**
University Intellectual Property Committee, **1997-present**
Informational Technology Coordinating Council, **1998-present**
Distance Learning Task Force, **1999-present**
Departmental Strategic Planning Advisory Committee, **2000-present**
Classroom Technology Enhancement Committee, **2000-present**
UT System Telecampus Oversight Committee, **2000-present**

Courses Taught at the University of Texas:

Fall 1990	Chemistry 341 Advanced Organic Synthesis Laboratory	16 students.
Spring 1991	Chemistry 610A/618A Sophomore Organic Chemistry	120 students.

Spring 1992	Chemistry 610A/618A Sophomore Organic Chemistry	260 students.
Fall 1992	Chemistry 610A/618A Sophomore Organic Chemistry	360 students.
Spring 1993	Chemistry 610B Sophomore Organic Chemistry	349 students.
Fall 1993	Chemistry 610A/618A Sophomore Organic Chemistry	260 students.
Spring 1994	Chemistry 610B Sophomore Organic Chemistry	366 students.
Fall 1994	Chemistry 610B Sophomore Organic Chemistry	260 students.
Spring 1995	Chemistry 610B Sophomore Organic Chemistry	380 students.
Fall 1995	Chemistry 386J Graduate Physical Organic Chemistry	24 students.
Fall 1995	Dean's Scholars Seminar	23 students
Spring 1996	Chemistry 391 Graduate Mechanisms/Bioorganic	18 students.
Spring 1996	Dean's Scholars Seminar	27 students
Fall 1996	Chemistry 386J Graduate Physical Organic Chemistry	32 students
Fall 1996	Dean's Scholars Seminar	27 students
Spring 1997	Chemistry 610B Sophomore Organic Chemistry	395 students
Spring 1997	Dean's Scholars Seminar	23 students
Fall 1997	Chemistry 610A Sophomore Organic Chemistry	195 students
Fall 1997	Dean's Scholars Seminar	18 students
Spring 1998	Chemistry 610B Sophomore Organic Chemistry	300 students
Spring 1998	Dean's Scholars Seminar	23 students
Fall 1998	Dean's Scholars Seminar	23 students
Spring 1999	Dean's Scholars Seminar	8 students
Fall 1999	Chemistry 610A Sophomore Organic Chemistry	420 students
Fall 1999	Dean's Scholars Seminar	18 students
Spring 2000	Chemistry 610B Sophomore Organic Chemistry	413 students
Spring 2000	Dean's Scholars Seminar	17 students
Fall 2000	Dean's Scholars Seminar	20 students
Spring 2001	Chemistry 610B Sophomore Organic Chemistry	237 students
Spring 2001	Dean's Scholars Seminar	9 students
Fall 2001	Chemistry 610A Sophomore Organic Chemistry	354 students
Fall 2001	Dean's Scholars Seminar	14 students

Current Graduate Students:

Mark Olsen	Chemistry	Ph.D. Candidate	Expected 2002
Jeeyeon Lee	Chemistry	Ph.D. Candidate	Expected 2002
Jongsik Gam	Pharmacy	Ph.D. Candidate	Expected 2002
Greg Gabriel	Chemistry	Ph.D. Candidate	Expected 2002
Mary Ann Mensi	Chemistry	Masters Candidate	Expected 2001
Karl Griswold	Chemistry	Ph.D. Candidate	Expected 2004
George Mabry	Chemistry	Ph.D. Candidate	Expected 2004
Andrea Sok	Chemistry	Ph.D. Student	Expected 2005
Joe Rezcek	Chemistry	Ph.D. Student	Expected 2005
Navin Varadrajan	Chemistry	Ph.D. Student	Expected 2005

Current Graduate Students co-Supervised:

Jennifer Maynard	Chemical Eng.	Ph.D. Candidate	Expected 2002
Barrett Harvey	Molecular Biology	Ph.D. Student	Expected 2004
Raphael Levy	Molecular Biology	Ph.D. Student	Expected 2004

Current Post-Doctorals

Dr. Andrew Hayhurst

Previous Graduate Students Supervised

Richard E. Thomas	"The Progression of a Catalytic Immune Response. Molecular Recognition of Anions by Silica Bound Sapphyrin" *Current Position:* US Navy	Masters Thesis Awarded 1994
Britta H. Wilmore	"Phosphate versus Phosphorothioate Haptens in the Production of Catalytic Polyclonal Antibodies" *Current Position;* Post-Doctoral Fellow, University of Colorado Health Sciences Center, Denver, CO	Masters Thesis Awarded 1994
Kevin R. Shreder	"Studies in Biomolecular Recognition" *Current Position:* Research Scientist, Abbott Laboratories, Inc. Chicago, IL.	Ph.D.Thesis Awarded 1995
Michael B. Wallace	"Antibody Catalyzed Hydrolysis Reactions with Hydrophobic Structures" *Current Position:* Research Scientist, Aguoron Pharmaceuticals, Inc. La Jolla, CA	Masters Thesis Awarded 1995
David B. Stephens	"Catalytic Polyclonal Antibodies" *Current Position:* Lecturer, University of Central Arkansas, Conway, AR	Ph.D. Thesis Awarded 1996
Elizabeth A. Burks	"New Methods for Manipulating Single Chain Antibody Genes and Proteins for Efficient Structure Function Studies" *Current Position:* Post-Doctoral Fellow, University of Texas, Austin, TX	Ph.D. Thesis Awarded 1996
Amy Odenbaugh	"Factors Influencing the Polyclonal Catalytic Immune Response" *Current Position:* Post-Doctoral Fellow, Duke University, Durham, NC	Ph.D. Thesis Awarded 1996
R. Scott Lokey	"Aedamers: A Synthetic Approach to Higher Order Structure" *Current Position:* Post-Doctoral Fellow, Harvard University, Cambridge, MA	Ph.D. Thesis Awarded 1997
Gang Chen	"Antibody Engineering: Cloning, Screening and Assay" *Current Position:* Research Scientist, Dynazyme, Inc., La Jolla, CA	Ph.D. Thesis Awarded 1997
Eric Helms	"Investigations of Polyclonal Catalytic Antibodies"	Ph.D. Thesis Awarded 1997

	Current Position: Faculty Member, SUNY-Geneseo, Geneseo, NY	
Chandra Miller	"The Design, Synthesis and Screening of Napthalene Diimides With Antibacterial Activity" *Current Position:* Research Scientist, Dupont Corian, Buffalo, NY	Ph.D. Thesis Awarded 1999
Patrick Daugherty	"Screening Combinatorial Polypeptide Libraries Using Bacterial Surface Display and Fluorescence-Activated Cell Sorting" *Current Position:* Faculty Member, University of California, Santa, Barbara, CA	Ph.D. Thesis Awarded 1999
Meredith Murr	"Expanding Serpentercalators: Synthesis and Studies of an *octakis*-Intercalator" *Current Position:* Research Scientist, Celltech Chiroscience, Inc. Seattle, WA	Masters Thesis Awarded 1999
Mark Cubberley	"Understanding Solvent Effects In Aromatic Donor-Acceptor Interactions" *Current Position:* Faculty Member, Department of Chemistry, Alma College, Alma, Michigan	Ph.D. Thesis Awarded 2000
Vladimir Guelev	"Peptide-Based Polyintercalators As Sequence Specific DNA-Binding Agents" *Current Position:* Postdoctoral Fellow, Harvard Medical School, Cambridge, MA.	Ph.D. Thesis Awarded 2001
Andrew Zych	"Conformational Characterization of Abiotic Secondary Structures Based Aromatic Stacking" *Current Position:* Research Scientist, Albany Molecular Research, Inc., Albany, New York	Ph.D. Thesis Awarded 2000

Undergraduates Supervised in the Laboratory:

Joanne Tsai (6 semesters), Jessica Hernandez (6 semesters), Sharon Mauldin (4 semesters), Sarah White (4 semesters), Timothy Letsko (4 semesters), Silwan Chedid (4 semesters), Matthew Harting (4 semesters), Patina Mendez (4 semesters), Mingsheng Tang (3 semesters), John Gray (3 semesters), Jeff Waltersheid (3 semesters), Linda Marenus, (3 semesters), Payam Yazdanshenas (3 semesters), Matt Harting (3 semesters), Devin Griffiths (3 semesters), Jason Lozada (3 semesters), Ramal Weragoda (3 semesters), Jeffrey Cloud (3 semesters), Joseph Fresch (2 semesters), Robert Ray (2 semesters), Andrew Shea (2 semesters), Karen Anderson (2 semesters) Shanti Nulu (2 semesters), Todd Russell (2 semesters), Ben Egner (2 semesters), Raymond Joseph (2 semesters), Kevin King (2 semesters), Martin Kracklauer (2 semesters), Fahmida Molla (2 semesters), Charu Jain (2 semesters), Monita Poudyal (2 semesters), Jonathan Ward (2 semesters), Steven Allen (2 semesters), Heather

Henninger (1 semester), Elvira Aleman (1 semester), Dieuthu Nguyen (1 semester), Elizabeth Vaught (1 semester), Brian Thompson (1 semester), Marc Ibanez (1 semester), Dave Francis (1 semester), Robert Byerly (1 semester), Rich Almond (1 semester), Stephanie Butler (1 semester), Russell Vinik (1 semester), Hector Serrano (1 semester).

Among these students: Marc Ibanez was awarded a Howard Hughes Fellowship and an NSF Graduate Fellowship, and attended graduate school in Biochemistry at the University of California, Berkeley. Sarah White was also awarded an NSF Graduate Fellowship, and she attended graduate school in Chemistry at the California Institute of Technology. Karen Anderson attended graduate school in Chemistry at the University of California, Los Angeles. Linda Marenus attended graduate school in Chemistry at the University of California, Berkeley. Many of the others are now in medical schools throughout the state of Texas.

Invited Research Presentations:

1. Sept. 24, 1990 "New Approaches to Catalytic Antibodies," **Catalytica, Inc.**; Menlo Park, California.

2. Sept. 27, 1990 "Teaching Antibodies New Tricks" **Roche Products, Ltd.**; Welwyn Garden, Hertfordshire, England.

3. Oct. 1, 1990 "Tritylase Antibodies," **Ciba Foundation Symposium #159**; London, England.

4. Jan. 30, 1991 "Metalloantibodies" **1991 Metals In Biology Gordon Conference**; Ventura, California.

5. July 17, 1991 "Catalytic Antibodies, Teaching Antibodies New Tricks" **Dow Chemical Company**; Midland, Michigan.

6. Oct. 8, 1992 "Catalytic Antibodies, A Perspective" **Texas Christian University Chemistry Department**; Fort Worth, Texas.

7. Nov. 17, 1992 "Catalytic Antibodies, A Perspective" **American Association of Pharmaceutical Scientists National Meeting**; San Antonio, Texas.

8. Dec. 7, 1992 "Antibodies Expressed by *E. coli*" an invited poster at a symposium entitled Research Opportunities in Biomolecular Engineering: the Interface Between Chemical Engineering and Biology, sponsored by **NIH**; Washington, D.C.

9. Apr. 8, 1993 "Catalytic Antibodies, A Perspective" **Baylor College of Medicine, Dept. of Biochemistry**; Houston, Texas.

10. May 19, 1993 "Catalytic Antibodies, A Perspective" **University of Texas Medical School, Dept. of Pathology**; Houston, Texas.

11. May 15, 1994 "Catalytic Polyclonal Antibodies, A New Direction in Catalytic Antibody Research," **Searle Foundation Annual Meeting**; Chicago, Illinois.

12. July 19, 1994 "New Directions in Catalytic Antibody Research," **Kyoto University Department of Synthetic Chemistry and Biological Chemistry**; Kyoto, Japan.

13. July 21, 1994 "New Directions in Catalytic Antibody Research," **Hiroshima International Symposium on Molecular Recognition Involving Metal Catalysts**, Hiroshima University; Hiroshima, Japan.

14. Sept. 12, 1994 "New Directions in Catalytic Antibody Research," **The University of Pennsylvania, Department of Chemistry**; Philadelphia, Pennsylvania.

15. Sept. 13, 1994 "New Directions in Catalytic Antibody Research," **Princeton University, Department of Chemistry**; Princeton, New Jersey.

16. Sept. 15, 1994 "New Directions in Catalytic Antibody Research," **Pennsylvania State University, Department of Chemistry**; State College, Pennsylvania.

17. Nov. 9, 1994 "New Directions in Catalytic Antibody Research," **The University of Texas at Dallas, Department of Chemistry**; Richardson, Texas.

18. Dec. 1, 1994 "New Directions in Catalytic Antibody Research," **Merck Research Laboratories**, Rahway, New Jersey.

19. Dec. 14, 1994 "New Directions in Catalytic Antibody Research," **The University of Houston, Dept. of Biochemistry**; Houston, Texas.

20. Jan. 19, 1995 "New Directions in Catalytic Antibody Research," **Texas A&M University, Dept. of Chemistry**, College Station, Texas.

21. Mar. 30, 1995 "New Directions in Catalytic Antibody Research," **The University of Oregon, Dept. of Chemistry**, Eugene, Oregon.

22. Mar. 31, 1995 "New Directions in Catalytic Antibody Research," **The University of Washington, Dept. of Chemistry**, Seattle, Washington.

23. Apr. 12, 1995 "New Directions in Catalytic Antibody Research," **Yale University, Dept. of Chemistry**, New Haven, Connecticut.

24. Apr 13, 1995 "New Directions in Catalytic Antibody Research," **Dartmouth College, Dept. of Chemistry**, Hanover, Hew Hampshire.

25. May 9, 1995 "New Directions in Catalytic Antibody Research," **Stanford University, Department of Chemistry**, Palo Alto, California.

26. May 10, 1995 "New Directions in Catalytic Antibody Research," **California Institute of Technology, Dept. of Chemistry**, Pasadena, California.

27. May 12, 1995 "New Directions in Catalytic Antibody Research," **Ambion, Inc.**, Austin, Texas.

28. May 25, 1995 "A Texas View of Chemistry, The Study of Large Molecules In Living Systems, Artificial Systems, and Points In Between," **University of California, Dept. of Biochemistry and Chemistry**, La Jolla, California.

29. May 26, 1995 "A Texas View of Chemistry, The Study of Large Molecules In Living Systems, Artificial Systems, and Points In between," **The Scripps Research Institute, Dept. of Chemistry**, La Jolla, California.

30. September 18, 1995 "A Texas View of Chemistry, The Study of Large Molecules In Living Systems, Artificial Systems, and Points In between," **The University of Arkansas, Dept. of Chemistry**, Fayetteville, Arkansas.

31. October 27, 1995 "A Texas View of Chemistry, The Study of Large Molecules In Living Systems, Artificial Systems, and Points In between," **The University of Texas at Arlington, Dept. of Chemistry**, Arlington, Texas.

32. May 19, 1996 "Aedamers: Large Synthetic Molecules with a New Secondary Structural Motif," **The NATO Advanced Research Workshop**, Hotel Far Hills, Val-Morin, Quebec, Canada.

33. Nov. 8, 1996 "Aedamers and Serpentercalators: Large Synthetic Molecules that do Stuff." **Baylor University, Dept. of Chemistry**, Waco, Texas.

34. May 1, 1997 "Antibody Engineering" DARPA PI meeting on BWD Detection and Identification Technologies, Birmingham, Alabama.

35. Aug. 20, 1997 "Cell Surface Expression as a Vehicle for Enzyme Evolution." **IBC Conference on Directed Evolution of Industrial Enzymes**, San Diego, California.

36. Oct. 24, 1997 "Aedamers and Serpentercalators: Large Synthetic Molecules That Fold and Bind DNA." **New York University, Dept. of Chemistry**, New York, New York.

37. Oct. 27, 1997 "Novel High-Throughput Methodologies for the Enhancement of Antibody and Enzyme Activities" **DuPont Central Research Bioprocess Division, DuPont Experimental Station**, Wilmington, Delaware.

38. Dec. 1, 1997 "Aedamers and Serpentercalators: Large Synthetic Molecules That Fold and Bind DNA." **International Symposium for Design and Synthesis of Biofunctional Molecules, The University of Tokyo,** Tokyo, Japan.

39. Dec. 3, 1997 "Aedamers and Serpentercalators: Large Synthetic Molecules That Fold and Bind DNA." **Teijin Limited,** Tokyo, Japan.

40. Dec. 3, 1997 "Aedamers and Serpentercalators: Large Synthetic Molecules That Fold and Bind DNA." **Department of Chemistry, Hiroshima University,** Hiroshima, Japan.

41. Jan. 16, 1998 "High Throughput Methodologies for the Production of Engineered Antibodies and Proteins", DARPA Detection and Identification Meeting, **Utah State University**, Logan, Utah.

42. Jan. 27, 1998 "Serpentercalators: New Chemotherapeutic Molecules with Antibiotic Activity" American Cancer Society Board of Directors Meeting, **Austin Chapter of the ACS**, Austin Texas.

43. Feb. 11, 1998, "Minaturized Antibodies for Ultra-High Affinity Detection", DARPA Biosurveillance, Providing Detection for the New Millenium, **Applied Physics Laboratory**, Laurel, Maryland.

44. April 16, 1998 "Fighting Cancer with New Knowledge and Brute Force Chemistry", **Golden Goggles Invitational Lecture, Department of Chemistry, Middle Tennessee State University**, Mufreesboro, Tenneessee.

45. April 17, 1998 "Aedamers and Serpentercalators: Large Synthetic Molecules That Fold and Bind DNA." **Department of Chemistry, Vanderbilt University,** Nashville, Tennessee.

46. June 10, 1998 "Aedamers and Serpentercalators: Large Synthetic Molecules That Fold and Bind DNA." **XXIII International Symposium on Macrocyclic Chemistry,** Oahu, Hawaii.

47. July 28, 1998 "New Strategies for Designing Inexpensive but Selective Bioadsorbants for Environmental Pollutants: Selection of Specific Ligands & Their Cell Surface Expression", **Environmental Management Science Program Workshop,** Chicago, Illinois.

48. August 23, 1998 "Aedamers: Large Abiotic Molecules that Fold", **The American Chemical Society National Meeting**, Boston, Massachusetts.

49. August 25, 1998 "Serpentercalators: A New Class of DNA Binding Molecules", **The American Chemical Society National Meeting**, Boston, Massachusetts.

50. September 24, 1998 "New High Throughput Technologies for Antibody and Enzyme Engineering", **Abbott Laboratories, Inc.**, Abbott Park, Illinois.

51. October 6, 1998 "Aedamers and Serpentercalators: Large Synthetic Molecules that Fold and Bind DNA", **Department of Chemistry, The University of New Brunswick**, New Brunswick, Canada.

52. October 13, 1998 "Aedamers and Serpentercalators: Large Synthetic Molecules that Fold and Bind DNA", **Department of Chemistry, The University of California at Irvine,** Irvine, California.

53. November 2, 1998 "Aedamers and Serpentercalators: Large Synthetic Molecules that Fold and Bind DNA", **Southwest Regional ACS Meeting**, Symposium on DNA Bing Agents, From Laboratory to the Clinic, Baton Rouge, Louisiana.

54. November 11, 1998 "Aedamers and Protein Evolution," **Department of Chemistry, The University of Illinois**, Champaign-Urbana, Illinois.

55. March 5, 1999 "Aedamers and Serpentercalators: Large Synthetic Molecules that Fold and Bind DNA", **Department of Chemistry, Duke University**, Raleigh-Durham, North Carolina.

56. March 11, 1999 "Aedamers and Serpentercalators: Large Synthetic Molecules that Fold and Bind DNA", **Department of Chemistry, Texas A&M University**, Commerce, Texas.

57. May 28, 1999 "Selecting for Altered Enzyme Function on Gram Negative Bacterial Cell Surfaces", **Conference on the Biomedical and Biotechnological Use and Further Development of Phage Display**, Montpellier, France.

58. July 27, 1999 "Selecting for Altered Enzyme Function on Gram Negative Bacterial Cell Surfaces" **Biochemical Engineering Conference 11, Molecular Diversity in Discovery and Bioprocessing**, Salt Lake City, Utah.

59. Feb. 2, 2000 "Manipulating Relatively Large Molecules: From Foldamers to DNA Binding Agents to Enzymes", **Department of Chemistry, University of Texas at Dallas**, Richardson, Texas.

60. April 13, 2000 "A New Approach to DNA Binding Therapeutics," **Austin Chapter of the American Cancer Society,** Austin, Texas.

61. August 14, 2000 "At First I Thought it was the Flu....Research Efforts to Produce Receptors for Use Against Bioterrorism", Bioterrorism Conference, **Texas Department of Health**, Austin, Texas.

62. September 1, 2000 "The Chemistry of Large Molecular Systems; From Aedamers to Enzymes", **Department of Chemistry and Biochemistry, The University of Texas at Austin,** Austin, Texas.

63. September 18, 2000 "The Chemistry of Large Molecular Systems; From Aedamers to Enzymes", **Department of Chemistry, Stanford University**, Stanford, California.

64. November 15, 2000 "The Chemistry of Large Molecular Systems; From Aedamers to Enzymes", **Department of Chemistry, University of Michigan**, Ann Arbor, Michigan.

65. November 17, 2000 "The Chemistry of Large Molecular Systems; From Aedamers to Enzymes", **Department of Chemistry, The University of Wisconsin**, Madison, Wisconsin.

66. February 1, 2001 "Using FACS to Screen Protein Libraries", **5th Lake Tahoe Symposium on Molecular Diversity**, Lake Tahoe, California.

67. February 20, 2002 "The Chemistry of Large Molecular Systems, from Foldamers to Enzymes", **Department of Chemistry, The University of Delaware**, Newark, Delaware.

68. March 2, 2002 "Using FACS to Screen Protein Libraries", **Evolvability and Robustness of Molecules and Microbes**, The Santa Fe Institute, Santa Fe, New Mexico.

Invited Presentations On New Teaching Techniques:

1. Feb. 20, 1995 "Computers in Chemistry; an Interactive Lecture," **Southwestern University, Dept. of Chemistry**, Georgetown, Texas.

2. Apr 13, 1995 "Computers in the Chemistry Classroom," **Dartmouth College, Dept. of Chemistry**, Hanover, Hew Hampshire.

3. June 6, 1996 "Buzz Lightyear Meets Carbon: Computer Animation in Chemistry Learning", **The Texas Energy Science Symposium**, UT Austin, Austin, Texas.

4. July 18, 1996 "Technology in the Chemistry Classroom," **The University of Texas at Austin**, Conference on technology in K-12 education sponsored by the O'Donnell Foundation.

5. Jan. 7, 1997 "Buzz Lightyear Meets Carbon: Computer Animation in Chemistry Learning", **The University of Texas at Austin**, Experienced Faculty Conference.

6. Feb. 5, 1997 "Buzz Lightyear Meets Carbon: Computer Animation in Chemistry Learning", **The University of Texas at Austin**, UT LAMP (Learning Activities for Mature People).

7. April 12, 1997 "Buzz Lightyear Meets Carbon: Computer Animation in Chemistry Learning", **The Texas State Science Fair**, Austin Convention Center, Austin, Texas.

8. June 5, 1997 "Buzz Lightyear Meets Carbon: Computer Animation in Chemistry Learning", **The Texas Energy Science Symposium**, UT Austin, Austin, Texas.

9. July 25, 1997 "Buzz Lightyear Meets Carbon: Computer Animation in Chemistry Learning", **The Honor's Colloquium**, UT Austin, Austin, Texas.

10. June 4, 1998 "Buzz Lightyear Meets Carbon: Computer Animation in Chemistry Learning", **The Texas Energy Science Symposium**, UT Austin, Austin, Texas.

11. July 24, 1998 "Buzz Lightyear Meets Carbon: Computer Animation in Chemistry Learning", **The Junior Honor's Colloquium**, UT Austin, Austin, Texas.

12. March 3, 1999 "Buzz Lightyear Meets Carbon: Computer Animation in Chemistry Learning", **CIT Faculty Fellows Symposium Series**, UT Austin, Austin, Texas.

13. June 3, 1999 "Buzz Lightyear Meets Carbon: Computer Animation in Chemistry Learning", **The Texas Energy Science Symposium**, UT Austin, Austin, Texas.

14. August 17, 2000 "What is Good Teaching?", **New Faculty Symposium, Center for Teaching Effectiveness,** UT Austin, Austin, Texas.

15. June 6, 2001 "Where are the Electrons: Technology and Chemistry Instruction", **The Texas Energy Science Symposium**, UT Austin, Austin, Texas.

16. July 27, 2001 "Where are the Electrons: Technology and Chemistry Instruction", **The Junior Honor's Colloquium**, UT Austin, Austin, Texas.

17. August 22, 2001 "Balancing the Different Roles of a Professor", **New Faculty Symposium, Center for Teaching Effectiveness,** The University of Texas at Austin, Austin, Texas.

Publications:

1. "The Pocket Porphyrin; A Hemoprotein Model with Lowered CO Affinity." Collman, J.; Brauman, J.; Collins, T.; Iverson, B.L. and Sessler, J. *J. Am. Chem. Soc.*, 1981, 103, 2450-2452.*

2. "O_2 and CO Binding to Iron (II) Porphyrins: A Comparison of the 'Picket Fence' and 'Pocket' Porphyrins." Collman, J.; Brauman, J.; Iverson, B.; Sessler, J; Morris, R. and Gibson, Q. *J. Am. Chem. Soc.*, 1983, 105, 3052-3064.*

3. "Synthesis and Characterization of the 'Pocket' Porphyrins." Collman, J.; Brauman, J; Collins, T.; Iverson, B.; Lang, G.; Pettman, R.; Sessler, J. and Walters, M. *J. Am. Chem. Soc.*, 1983, 105, 3038-3052.*

4. "Nonenzymatic Cleavage of Single-Stranded DNA to Nucleotide Resolution. DNA Methyl Thioester Probes." Iverson, B.L. and Dervan, P.B. *J. Am. Chem. Soc.* 1987, 109, 1241-1243.*

5. "Adenine Specific DNA Chemical Sequencing Reaction." Iverson, B.L. and Dervan, P.B. *Nucl. Acids Res.*, 1987, 15, 7823-7830.*

6. "Nonenzymatic Sequence Specific Methyl Transfer to Single-Stranded DNA." Iverson, B. L. and Dervan, P.B. *Proc. Nat. Acad. Sci. USA*, 1988, 85, 4615-4619.*

7. "Design and Chemical Synthesis of a Sequence Specific DNA Cleaving Protein." Mack, D.P.; Iverson, B.L. and Dervan, P.B. *J. Am. Chem. Soc.*, 1988, 110, 7572-7574.*

8. "Sequence-Specific Peptide Cleavage Catalyzed by an Antibody." Iverson B.L. and Lerner, R.A. *Science,* 1989, 243, 1184-1188.*

9. "Selective Cleavage of Trityl Protecting Groups Catalyzed by an Antibody." Iverson, B.L., Jahangiri, G.K., Cameron, K. and Pasternak, D. *J. Am. Chem. Soc.,* 1990, 112, 5320-5323.*

10. "Metalloantibodies" Iverson, B.L.; Iverson, S.A.; Roberts, V.; Tainer, J.; Getzhoff, E.; Benkovic, S.J. and Lerner, R.A. *Science*, 1990, 249, 659-662.*

11. "Antibody Remodeling: A General Solution to the Design of a Metal-Coordination Site in an Antibody Binding Pocket" Roberts, V.; Iverson, B.L.; Iverson, S.A.; Benkovic, S.J.; Lerner, R.A.; Tainer, J. and Getzhoff, E. *Proc. Nat. Acad. Sci., USA,* 1990, 87, 6654-6660.*

12. "Tritylase Antibodies" Iverson, B. L.; Iverson, S. A.; Jahangiri, G. K.; Cameron, K.; Pasternak, D. and Lerner, R. A. in Catalytic Antibodies, Wiley, (Ciba Foundation Symposium 159) 1991, p. 227-235.#

13. "Adenine-Specific DNA Chemical Sequencing Reaction," Iverson, B.L. and Dervan, P.B., 1993, *Meth. Enz.* , 218, 222-227.#

Publications Since Arriving at the University of Texas:

14. "Catalytic Polyclonal Antibodies." Iverson, B. L. and Stephens, D. *Biochem. Biophys. Res. Commun.*, 1993, 192, 1439-1444.*

15. "Production and Fluorescence Activated Cell Sorting of *E. coli* Expressing a Functional Antibody Fragment on the External Surface." Francisco, J.; Iverson, B. L. and Georgiou, G. *Proc. Nat. Acad. Sci., USA*, 1993, 90, 10444-10448.*

16. "Phosphate Recognition by Sapphyrin. A New Approach to DNA Binding." Iverson, B.L., Shreder, K.; Kral, V. and Sessler, Jonathan L. *J. Am. Chem. Soc.*, 1993, 115, 11022-11023.*

17. "Phosphate vs. Phosphorothioate Haptens for the Production of Catalytic Antibodies," Willmore, B. and Iverson, B. L. *J. Am. Chem. Soc.*, 1994, 116, 2181-2182.*

18. "Molecular Recognition of Anionic Species by Silica Gel Bound Sapphyrin," Iverson, B.L.; Thomas, R.E.; Kral, V. and Sessler, J.L. *J. Am. Chem. Soc.*, 1994, 116, 2663-2664.*

19. "Interactions Between Expanded Porphyrins and Nucleic Acids." Iverson, B.L.; Shreder, K.; Kral, V.; Smith, D. A.; Smith, J. and Sessler, J. L. *Pure Appl. Chem.*, 1994, 66, 845-850.#

20. "Electron Transfer Reactions of Ruthenium Tris(bipyridyl)-Viologen Diads: Comparison of the Distance Dependence of Electron Transfer Rates in the Normal and Inverted Regions." Yonemoto, E. H.; Schmehl, R. H.; Hubig, S. M.; Riley, R. L.; Iverson, B. L. and Mallouk, T. E. *J. Am. Chem. Soc.* 1994, 116, 4786-4795.*

21. "Screening of Single-Chain Fv Antibody Libraries by Display on *E. coli* Surface and Fluorescence Activated Cell Sorting." Georgiou, G.; Francisco, J.; Chen, G. and Iverson, B.L. in *Better Living Through Innovative Biotechnology*, Ed. W.K. Teo, M.G.S. Yap, and S.K. Oh (NUS Press, Singapore) 1994, 40-43.#

22. "Site-Specific Hydrolysis of RNA by Europium(III)-Texaphyrin Conjugated to a Synthetic Oligodeoxyribonucleotide," Magda, D.; Miller, R.A.; Sessler, J.L. and Iverson, B.L. *J. Am. Chem. Soc.*, 1994, 116, 7439-7440.*

23. "Polyclonal Antibodies and Catalysis," Stephens, D.B.; Wilmore, B.H. and Iverson, B.L. *Bioorg. and Med. Chem.*, 1994, 2, 653-658.*

24. "Expanded Porphyrins. Receptors for Cationic, Anionic, and Neutral Substrates." Sessler, J.L.; Burrell, A.K.; Furuta, H.; Hemmi, G.; Iverson, B.L.; Kral, V., Magda, D.J.; Mody, T.; Shreder, K.; Smith, D. and Weghorn, S.J. *Transition Metals in Supramolecular Chemistry* NATO ASI Series, Kluwer, Amsterdam., 1994, 448, 391-408.#

25. "Rapid, High Yield Recovery of a Recombinant Digoxin Binding scFv from *E. coli,"* Burks, E., and Iverson, B.L. *Biotechnology Progress*, 1995, 11, 112-114.*

26. "Polyclonal Antibodies Produced *via* Immunization with a Tris(Bipyridine)Ruthenium(II)-Methyl Viologen Conjugate Hapten: A Photophysical Investigation with Surprisingly 'Homogeneous' Behavior," Shreder, K.; Hariman, A. and Iverson, B.L. *J. Am. Chem. Soc.*, 1995, 117, 2673-2674.*

27. "Ribozymes, Recognition, and Evolution," Iverson, B.L., *Chem. and Biology*, 1995, 2, 67-70.#

28. "Synthetic Molecules That Fold Into A Pleated Secondary Structure In Aqueous Solution," Lokey, R. Scott and Iverson, B.L. *Nature*, 1995, 375, 303-306.*

29. "Catalytic Polyclonal Antibodies", Iverson, B.L. *CHEMTECH*, 1995, 25, 17-21.#

30. "Synthesis of Sapphyrin-EDTA Conjugate and Preliminary Cleavage Results Using a Supercoiled Plasmid DNA Assay," Iverson, B.L., Shreder, K., Morishima, T. and Sessler, J.L. *J. Org. Chem.* 1995, 60, 6616-6620.*

31. "The Influence of Hapten Size on the Catalytic Activity of Elicited Polyclonal Antibodies," Wallace, M.B. and Iverson, B.L. *J. Am. Chem. Soc.* 1996, 118, 251-252.*

32. "The Interaction of Sapphyrin With Phosphorylated Species of Biological Interest," Iverson, B.L., Shreder, K.S., Kral, V., Sansom, P. and Sessler, J., *J. Am. Chem. Soc.* 1996, 118, 1608-1616.*

33. "Molecular Recognition of a Monoclonal Antibody Cross-Reactive for Derivatives of $Ru(bpy)_3^{2+}$ and $Ru(phen)_3^{2+}$," Shreder, K.S. Hariman, A. and Iverson, B.L., *J. Am. Chem. Soc.* 1996, 118, 3192-3201.*

34. "Generation by Electron Transfer of an Emitting State Not Observed by Photoexcitation in a Linked $Ru(bpy)_3^{2+}$-Methyl Viologen," Xu, X., Shreder, K., Iverson, B.L. and Bard, A.J., *J. Am. Chem. Soc.* 1996, 118, 3656-3660.*

35. "A Quantitative Immunoassay Utilizing *Escherichia coli* Cells Possessing Surface-Expressed Single Chain Fv Molecules," Chen, G., Cloud, J., Georgiou, G. and Iverson, B.L., *Biotech. Progress.* 1996, 12, 572-574.*

36. "The Evolution of Catalytic Activity Throughout a Polyclonal Immune Response Elicited by a Transition State Analog Hapten," Shreder, K.R., Thomas, R., Wallace, M.B., Helms, E. and Iverson, B.L., *Isr. J. of Chem.* 1996, 36, 215-220.*

37. "Sapphyrin-Oligonucleotide Conjugates. Novel Sequence-Specific DNA Photomodifying Agents with Increased Binding Affinity" Sessler, J.L., Sansom, P.I., Kral, V., O'Connor, D. and Iverson B. *J. Am. Chem. Soc.* 1996, 118, 12322-12330.*

38. "The Display of Heterologous Proteins on the Surface of Microorganisms: From the Screening of Combinatorial Libraries to Live Recombinant Vaccines," Georgiou, G., Stathopolous, C., Daugherty, P.S., Nayak, A.R., Iverson, B.L. and Curtiss, R. *Nature/Biotechnology*, 1997, 15, 29-34.*

39. "Betas are Brought into the Fold," a News and Views Commentary, *Nature*, 1997, 385, 113-115.

40. "*In vitro* Scanning Saturation Mutagenesis of an Antibody," Burks, E.A., Chen, G., Georgiou, G. and Iverson, B.L. *Proc. Nat. Acad. Sci., USA*, 1997, 94, 412-416.*

41. "Aedamers: Large Synthetic Molecules with a New Secondary Structural Motif," Lokey, R.S. and Iverson, B.L. *Supramolecular Chemistry* NATO ASI Series, Kluwer, Amsterdam, In Press.*

42. "A New Class of Polyintercalating Molecules," Lokey, R.S., Kwok, Y, Guelev, V., Pursell, C.J., Hurley, L.H. and Iverson, B.L., *J. Am. Chem. Soc.*, 1997, 119, 7202-7210.*

43. "Enhanced DNA Photocleavage and Binding Properties of Sapphyrin-Polyamine Conjugates," Sessler, J.L., Andrievsky, A., Sansom, P.I., Kral, V. and Iverson, B., *Bioorg. and Med. Chem. Letters,* 1997, 7, 1433-1436.*

44. "Be Careful What You Wish For...." Iverson, B. and Breaker, R.R. *Trends in Biotech.*, 1998, 16, 52-53.#

45. "Polyclonal Catalytic Antibody Variability", Stephens, D.B. and Iverson, B.L. *Biochem. J.*, 1998, 332, 127-134.*

46. "A Fertile and Dynamic Sea", Iverson, B.L. *Nature*, 1998, 395, 133.#

47. "Antibody Affinity Maturation Using Bacterial Surface Display," Daugherty, P., Chen, G., Olsen, M., Iverson, B.L. and Georgiou, G. *Protein Eng.*, 1998, 11, 825-832.*

48. "*In vitro* Scanning Saturation Mutagenesis of all the Specificity Determining Residues in an Antibody Binding Site," Chen, G., Dubrawsky, I., Mendez, P., Georgiou, G. and Iverson, B. L. *Protein Eng.* 1999, 12, 349-356.*

49. "An Amphiphilic Folding Molecule that Undergoes an Irreversible Conformational Change," Nguyen, John Q. and Iverson, B.L., *J. Am. Chem. Soc.*, 1999, 121, 2639-2640.*

50. "Altered Sequence-Specificity Identified from a Library of DNA-Binding Small Molecules", Guelev, V., Harting, M., Lokey, R.S. and Iverson. B.L., *Chemistry and Biology*, 2000, 7, 1-8.*

51. "Development of an Optimized Expression System for the Screening of Antibody Libraries Displayed on the *E. coli* Surface," Daugherty, P., Olsen, M., Iverson, B.L. and Georgiou, G., *Protein Eng.* 1999, 12, 613-621.*

52. An Investigation of Antibody Acyl Hydrolysis Catalysis Using a Large Set of Related Haptens," Odenbaugh, A.L., Helms, E. D., Iverson, B.L. *Bioorg. and Med. Chem.* 2000, 8, 413-426.*

53. "Quantitative Analysis of the Effect of the Mutation Frequency on the Affinity Maturation of scFv Antibodies," Daugherty, P., Chen, G., Iverson, B.L. and Georgiou, G., *Proc. Nat. Acad. Sci., USA* 2000, 97, 2029-2034.*

54. "Flow Cytometric Screening of Cell-Based Libraries," Daugherty, P., Iverson, B.L. and Georgiou, G.,*J. Immunol. Meth.*, 2000, 243, 211-227.*

55. "From a Distance: In the Rush to Educational Quantity Many are Pushing, Two Professors Caution the Establishment to Look for Quality When it Comes to Distance Education," Iverson B.L. and Trimble, J. *The Texas Alcalde*, 2000, 89, 40-44.

56. "Synthesis and Conformational Characterization of Tethered, Self-Complexing 1,5-Dialkoxynaphthalene/1,4,5,8-Naphthalenetetracarboxylic Diimide Systems", Zych, A. and Iverson, B.L. *J. Am. Chem. Soc.*, 2000, 122, 8898-8909.*

57. "Function-based Isolation of Novel Enzymes from a Large Library" Olsen, M., Stephens, D., Griffiths, D., Daugherty, P., Georgiou, G. and Iverson, B.L., *Nature/Biotechnology*, 2000, 18, 1071-1074.*

58. "High Throughput Screening of Enzyme Libraries", Olsen, M., Iverson, B.L., and Georgiou, G., *Curr Opin Biotechnol.* 2000, 11, 331-337.*

59. "*In vitro* Scanning Saturation Mutagenesis", Maynard, J., Georgiou, G., and Iverson, B.L., *Methods in Molecular Biology,* 2001, 182, 149-164.*

60. "Design, Synthesis and Characterization of Polyintercalating Ligands", Guelev, V., Cubberley, M., Murr, M., Lokey, R.S. and Iverson, B.L. *Methods in Enzymology,* 2001, 340, 556-572.*

61. "An *Octakis*-Intercalating Molecule", Murr, M. and Iverson, B.L. *Bioorganic and Medicinal Chemistry*, 2001, 9, 1141-1148.

62. "Peptide bis-Intercalator Binds DNA via Threading Mode with Sequence-Specific Contacts in the Major Groove" Guelev, V., Lee, J., Ward, J. and Iverson, B.L. *Chemistry and Biology*, 2001, 8, 415-425.

63. "The Synthesis and Screening of 1,4,5,8-Naphthalenetetracarboxylic Diimide-Peptide Conjugates with Antibacterial Activity", Miller, C., Weragoda, R., Izbicka, E. and Iverson, B.L. *Bioorganic and Medicinal Chemistry,* 2001, 9, 2015-2024.

64. "Periplasmic Expression with Cytometric Screening (PECS): A Facile Method for the Isolation of High Affinity Ligand Binding Proteins" Chen, G., Hayhurst, A., Thomas, J.G., Harvey, B.R., Iverson, B.L. and Georgiou, G. *Nature/Biotechnology,* 2001, 19, 537-542.

65. "^{1}H NMR Investigation of Solvent Effects in Aromatic Stacking Interactions", Cubberley, M. and Iverson, B.L., *J. Am. Chem. Soc.*, 2001, 123, 7560-7563.

66. "Changing DNA Grooves - A 1,4,5,8-Naphthalene Tetracarboxylic Diimide *Bis*-Intercalator with the Linker (□-Ala)$_3$-Lys in the Minor Groove," Guelev, V., Sorey, S., Hoffman, D. and Iverson, B.L. *J. Am. Chem. Soc.*, 2002, 124, 2864-2865.*

67. "Models of Higher-Order Structure: Foldamers and Beyond," Cubberley, M. and Iverson, B.L., *Current Opin. In Chem. Biology*, 2001, 5, 650-653.

68. "Production of Correctly Folded Fab Antibody Fragment in the Cytoplasm of Escherichia coli trxB gor Mutants via the Coexpression of Molecular Chaperones", Levy, Raphael; Weiss, Robert; Chen, Gang; Iverson, Brent L.; Georgiou, G., *Protein Expression and Purification* 2001, 23, 338-347.

69. "Recombinant Antibody Fragment Mediated Protection to Anthrax Toxin Challenge Correlates with Antigen Affinity", Maynard, J.A., Leppla, S.H., Brasky, K., Patterson, J.L., Iverson, B.L. and Georgiou, G. *Nature/Biotechnology,* submitted*

For the above, an "*" denotes a refereed publication, a "#" denotes an invited publication.

Current Research Funding: [Total costs are listed (direct plus indirect). For multiple-investigator grants the amounts have been divided by the number of PIs except for the NIH Training Grant (#3)]

1. National Science Foundation, Project # CHE-0079106, "Molecular Velcro", 9/1/00-8/30/03 **$348,198**

2. National Institutes of Health, Project #: T32 GM 087474 "Biotechnology of Molecular Recognition Training Grant," 7/1/99-6/30/02, **$689,610** (I am PI and the Training Program administrator. There are 18 participating faculty).

3. Welch Foundation, Project # F-1188, "Second Generation Aedamers; Improved Stability by Design" 6/1/99-5/31/02, **$135,000**.

4. "Optimization of Antibodies for use in Biotechnology Research", Project # 003658-0423-1999, Texas Higher Education Coordinating Board ATP Program, 1/1/00-7/31/02, **$115,950,** (co-PI w/ George Georgiou).

5. U. S. Army/MURI, Project # DAAD19-99-1-0207 "Texas Consortium for the Development of Biological Sensors," 4/30/99-4/29/04, **$560,000,** (PI is A. Ellington, 9 total PI's)

6. Arnold & Mabel Beckman Foundation, "Center for the Design and Fabrication of Sensor Arrays," 1/1/99-9/1/02, **$187,500,** (PI is Jason Shear, 8 total PI's)

7. U.S. Army, "A Comprehensive Approach To BWD Detection", 7/1/00-6/30/02, **$550,000**, (PI is Steve Kornguth, 9 total PI's)

8. Texas Higher Education Coordinating Board ARP Program, "Biologically Engineered Evolution of Physical Properties of Semiconductor Quantum Dots", 1/1/02-12/31/04, **$200,000,** (co-PI w/ Angela Belcher).

Pending Research Funding: [Total costs are listed (direct plus indirect).]

1. National Institutes of Health, "Evolutionary Design of Enzyme Chemistry and Specificity," 1/16/02-1/15/06, **$1,470,000.** (Co-PI with George Georgiou)

2. National Institutes of Health, "Interconversion of Specificity within Enzyme Families," 7/1/02-6/30/07, **$2,389,000.** (Program Project with Steve Benkovic (Penn State) P.I. and several co-P.I.'s).

Professionally Related Activities:

Dr. Sheila Iverson (wife) and I have written three study guides to accompany Organic Chemistry texts published by Saunders College Publishing. The first is an 850 page, two volume study guide and solutions manual to accompany the Organic Chemistry textbook by William Brown, published by Saunders College Publishing. A second 500 page study guide and solutions manual to accompany an introductory Organic Chemistry textbook came out in the fall of 1996. The third is an 850 page second edition of the first Study Guide that was released in the fall of 1997 and is currently used in our department. This latter study guide is currently in its seventh printing.

Patents Issued:

1. "Polyvalent Metal Ion-Containing Antibody Combining Sites" (Patent #5236825)
2. "Sapphyrin Derivatives And Conjugates" (Patent #5457195)
3. "Sapphyrin Chelator Derivatives" (Patent #5530123)
4. "Texaphyrin Metal Complex Mediated Ester Hydrolysis" (Patent # 5559207)
5. "Methods of Expanded Porphyrin-Oligonucleotide Conjugate Synthesis" (Patent # 5565552)
6. "Texaphyrin and Uses Thereof" (Patent # 5567687)
7. "Texaphyrin Solid Supports and Devices" (Patent # 5594136)
8. "Chromophore Probe for Detection of Nucleic Acids" (Patent # 5595726)
9. "Phosphoramidite Derivatives of Texaphyrins" (Patent # 5633354)
10. "DNA Photocleavage Using Texaphyrins" (Patent # 5607924)
11. "Method of Cleaving DNA" (Patent # 5672490)
12. "Method for Separating Molecules" (Patent # 5744302)
13. "Matrix Supported Saphhyrins" (Patent # 5808059)
14. "In vitro Scanning Saturation Mutagenesis of Proteins" (Patent # 6180341)

5 Patents Currently Pending

Consulting and Service:

1. Pharmacyclics, Inc., Santa Clara, California; 1992-present
2. Maxygen, Inc; 2001-present
3. Member Scientific Advisory Board, Ambion Inc., Austin, Texas; 1995-present
4. Member Award Programs Advisory Committee, Research Corporation, Tucson, Arizona; 1998-present
5. Member Bioorganic and Natural Products NIH Study Section; 1998-present